LAND USE FISCAL IMPACT MODEL: MEASURING IMPACTS OF OUTER CONTINENTAL SHELF DEVELOPMENT IN THE COASTAL REGION OF SOUTH CAROLINA

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BY

OLGUN ERSENKAL
BARRY NOCKS

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DEPARTMENT OF PLANNING STUDIES, CLEMSON UNIVERSITY

PROJECT RESEARCH STAFF

Principal Investigators:

Olgun Ersenkal, Associate Professor of Planning Studies, Clemson University.

Barry C. Nocks, Associate Professor of Planning Studies, Clemson University.

Research Associate:

James London, Assistant Professor of Public Administration, College of Charleston.

Anthony Corey, Research Assistant, Department of Planning Studies, Clemson University.

Graduate Assistants:

Nicholas Avrakotos

Nann Boggs

Donald Fadel

James Hill

Danny Taylor

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INTRODUCTION

It is clear that energy development along the Outer Continental Shelf (OCS) of South Carolina will have a definite impact on the coastal counties of the State due to the location of energy producing industry. In addition to changing the character of many sections of the coastal zone, the increased population and industry will greatly affect demands for public services at the city and county levels.

The Clemson Land-Use Fiscal Impact Model (Impact Model) is a computer based method that projects land development patterns and associated impacts of that growth in the cities and counties of the coastal region based on assumed location of major industrial plants. For example, a refinery and deep water port are proposed to be located near Georgetown. Given a specific location, size and employment pattern for that development, the model projects the following information:

1. Population growth due to new employees and their families along with the location of those families;
2. Growth in commercial and related retail uses in terms of both income and employment;
3. Overall land use patterns for the counties in the coastal zone;
4. Levels of local expenditures (by city and county) for public services due to increased population and industry;
5. Levels of local government revenue (by city and county) for units of local government;
6. Net difference between revenues and expenditures (or fiscal impact) for city and county levels of government as a result of projected growth.

Use of this model will enable public officials at the city, county, and coastal

zone levels to identify the anticipated physical, social and financial consequences of growth. Current pressures of inflation with current levels of public services create extremely difficult problems that local units of government must deal with. When significant levels of growth that can change both the size and basic nature of communities are added to the pressures of inflation, it is only prudent to anticipate these changes and be prepared for their consequences. It is also possible to use the impact model to compare the results of different patterns of industrial location, thereby enabling local officials to consider the best location for industry from the government's point of view. If, for example, a specific location for a refinery results in far more government expenditures than revenues in comparison to several other possible sites, government officials would be wise to encourage plant location at one of the more cost effective sites. The magnitude of anticipated energy related industrial development along the generally non-industrialized coastal zone of South Carolina requires careful consideration of the consequences of such growth for local units of government. Projections of these consequences will be derived from the impact model in a form that local decision-makers can use so that prudent actions may be taken either to influence growth in a desirable manner or prepare for growth that is most likely to occur due to forces beyond the control of local governments. In addition, it will be possible to use infomation gained in developing the model in identifying hidden costs of development (i.e., increased traffic and congestion) and study in greater depth specific levels of tax revenue under local conditions.

Approach

The specific methodology used to develop the impact model as well as the

specific tasks required are discussed in some detail in the Project Proposal, "Development of a Computerized Land Use-Fiscal Impact Model to Measure OCS Development in the Coastal Region of South Carolina." This proposal envisioned a three year development process leading to the development and operationalization of this model for the South Carolina Coastal Region. For a variety of reasons, only the first year of this three year process was funded. Therefore, while the primary tasks outlined in the first year funding application were addressed, attention was also devoted to additional activities required to make the model operational. In short, some of the developmental and programming work envisioned for the second year of funding were also performed during this first year of study.

A listing of the working papers completed indicates the accomplishments of this project:

The Coastal Energy Impact Model: Conceptual Framework and Structural Equations

Employment, Population, and Expenditure Trends in the Coastal Region of South Carolina: 1967-1977

Determinants of Local Government Revenues and Expenditures in South Carolina

A Land Use Inventory of the Coastal Region in South Carolina

Public Facilities Data for the South Carolina Coastal Area

Trends in Enrollment Patterns, Expenditures, and Revenues for Educational Facilities in the Coastal Region of South Carolina

The Economic Impact of Industry and Energy Locations in Coastal South Carolina

An Initial Users Manual: Land-Use Fiscal Impact Model

These papers are summarized in the following section, followed by a discussion of future steps to be taken in implementing this model in the coastal region of South Carolina.

GROWTH TRENDS IN THE COASTAL REGION OF SOUTH CAROLINA

The Coastal Region of South Carolina is experiencing accelerated growth and development due to an influx of industry into the area. A Clemson Land-Use Fiscal Impact Model was developed to examine potential net benefits to communities and associated impacts of growth in the cities and counties, based on assumed location of major industrial plants. This model will enable planners and local government officials to make more informed decisions regarding the encouragement of industrial development in specified areas. A detailed description of the model is provided later in this report.

Trends in population, employment, local government expenditures as well as public facility utilization in the coastal region of South Carolina will be discussed here.

Population Growth 1970-1977

The population of the region increased from 530,440 in 1970 to an estimate by the Bureau of Census of 612,736, which is an increase of 15.5%. Substantial deviations from this regional growth rate have been experienced by local government jurisdictions during the same period. Incorporated areas with 5,000 or less population grew by 30.6% during the same period, which is followed by 17.19% increase in population among small towns (5,000 - 10,000 population.) Other jurisdictions, i.e., cities, large towns and unincorporated areas increased at a slower rate than the region as a whole. These results are presented in Table 1.

Among the coastal counties in South Carolina, Dorchester, Berkeley, Horry, Jasper and Georgetown counties increased in population faster than

Table 1

Population In Coastal Municipalities 1970-1977

AREA	POPULATION 1970	POPULATION 1977	PERCENT CHANGE
City (25,000 +)	119,874	118,569	- 1.09
Large Town (10-25,000)	10,449	11,769	12.63
Small Town (5-10,000)	58,893	71,122	17.19
Village (5,000)	38,678	50,514	30.60
Unincorporated	311,910	357,763	14.67

*(Classifications based on 1970 Census data)

Table 2

Population Trends In The Coastal Counties
Of South Carolina

	POPULATION 1970	POPULATION 1977	NET CHANGE	CHANGE
Dorchester	32,276	49,678	17,402	+53.92
Berkeley	56,199	72,554	16,355	29.10
Horry	69,992	89,034	19,142	27.21
Jasper	11,885	14,158	2,273	19.12
Georgetown	33,500	39,310	5,810	17.34
Beaufort	51,136	57,624	6,488	12.69
Colleton	27,707	29,841	2,134	7.70
Charleston	247,565	260,537	12,972	5.24
Total	530,440	612,736	82,296	15.51

Source.

the region as a whole. On the other hand, an examination of net population changes indicate that a major increase in population took place in Horry, Dorchester, Berkeley, and Charleston Counties. Detailed information on these trends is provided in Table 2 . These results suggest that if these trends would continue significant increases in demand for public service will be felt in these counties particularly in towns with population less than 10,000.

Employment Growth 1970-1977

Significant increases in employment has been experience throughout the region between 1970 and 1977. Particularly Beaufort, Berkeley, Charleston, Dorchester and Horry Counties experienced substantial increases in employment in net as well as relative terms. The greatest net increase took place in Horry County where employment increased from 13,801 in 1970 to 24,813 in 1977. These results are presented in Table 3.

A careful examination of the geographic distribution of this growth also suggests that the region is growing most rapidly in areas neighboring the Charleston SMSA.

Analysis of the employment growth by sector in the region suggests that services increased most rapidly, growing 139.28%. Agriculture sector followed this rate with a gain of 85.21%. Which was followed by retail trade, finance, construction, manufacturing, transportation, and wholesale trade.

Table 3

Employment Trends In The Coastal Counties
Of South Carolina
1970-1977

	1970*	1977	NET CHANGE	CHANGE
Beaufort	5,315	11,987	6,672	212.32
Berkeley	4,133	7,282	3,149	136.92
Charleston	56,233	66,599	10,366	37.69
Colleton	4,962	5,913	951	36.24
Dorchester	3,949	6,409	2,460	87.62
Georgetown	7,695	9,993	2,298	70.29
Horry	13,801	24,813	11,012	102.56
Jasper	1,442	1,718	276	26.51

*1970 Figures are based on estimates by the Research Staff.

TRENDS IN LOCAL GOVERNMENT EXPENDITURES

There appears to be some positive correlation between employment and population growth and an increase in expenditures in the counties. In other words, low population and employment growth usually results in a low level of expenditure growth, while high population and employment growth occurs with high expenditure levels. Three counties were exceptions to this: Beaufort County experienced low population growth but high employment and expenditure growth; Dorchester County has high population and employment growth and low expenditure growth; and, Horry County saw high levels of growth in population and expenditures, yet had a low level of growth in employment.

Nevertheless, the apparent positive correlation between employment, population, and rate of growth in local government expenditures has significant growth management implications. It is clear that increases in growth, both in terms of population and employment, demand additional local services. To meet these demands, growth areas must be able to withstand such tremendous increases by planning for essential services. Consideration must also be given to sources of revenue in order to meet the increasing cost of providing expanded services. Those communities where growth has been anticipated and provided for are those which will best be able to maintain their community character, and have a much greater chance of avoiding problems usually associated with rapid growth.

Water and Sewer Services

This research project examined data regarding water and sewage treatment facilities in the South Carolina Coastal Zone. Since water is

Table 4

Annual Growth Rates For Population, Employment, And Expenditures For The Coastal South Carolina Counties In Order Of Growth

COUNTY	POPULATION %	EMPLOYMENT %	EXPENDITURES %
Dorchester	7.70	12.52	8.95
Berkeley	4.16	19.56	41.74
Horry	3.89	3.79	75.59
Jasper	2.73	14.65	90.31
Georgetown	2.48	7.18	19.42
Beaufort	1.81	30.33	72.61
Colleton	1.10	19.56	41.74
Charleston	0.75	5.38	19.94

NOTE: Population and employment figures are averaged for the 1979-1977 period; expenditure figures are averaged for the 1967-1977 period.

basic to life, the S.C. Coastal Council recognizes the importance of careful planning to accommodate for the demand and disposal of organic and inorganic wastes.

The report was compiled by survey method in which questionnaires were sent out to the 49 water and/or sewer providers in the area. In addition, a 1977 report of the S.C. Water Resources Commission provides data regarding water supply and usage. Data from both these sources are discussed in the report.

The survey and report show that with the exception of Charleston and Summerville, all the water systems have excess capacity. A more uniform measure of the growth that could be handled by existing capacity is the additional population that could be served. The results show that although values range from no excess in Charleston to additional 55,000 in N. Myrtle Beach, the overall capacity exists for approximately double the current coastal zone population.

Per capita use varies significantly among the systems. Most service areas have an average per capita use of between 50 and 80 gpd, but on Pawley Island. The average is 36 gpd compared to 212 gpd on Myrtle Beach. Industrial use of water places even larger demands on local water systems. Some of the industries in this area, however, have their own wells. In addition, the use of processed and unprocessed water is significant in some areas such as Charleston.

The capacity of sewage systems are more closely in tune to current usage than is the case in the water systems.

Educational Facilities

As the date in this report indicate, school enrollment on the eight

coastal counties of S.C. declined during the study period (1967-1977). Expenditure per pupil costs rose, however, at an average yearly rate of 11.7% (or 29.5% in actual dollars.) Revenues per pupil did not maintain the same rate of increase showing a yearly average of only 8.9% (or 24.4% in actual dollars.) The implications of the rapidly excelerating costs of educational services, as compared to the slower rate of revenue increases will undoubtedly be reflected in the quality of education available in S.C. schools. One aspect of this "quality" is the physical capability of existing facilities, and/or the feasibility of the existing system being able to handle future educational needs.

At first glance, the enrollment decreases would indicate a lower demand for new facilities. However, the physical conditions of individual buildings, as well as their availability to adapt to modern educational demands is a different matter. Each school, depending on its function, location, and educational level, would need to be studied individually, a task not possible in the scope of this report. Growth patterns will effect all school districts to varying degrees, and in order for localities to provide adequate educational services, the adequacy of existing facilities must be determined.

The preceding analysis of the growth trends during the 1970-1977 period in the coastal counties of South Carolina suggests that significant changes are taking place in the South Carolina coastal region particularly in Charleston and its neighboring counties. In order to minimize some of the negative impacts from growth, particularly in the provision of public services and in financing these services, utmost effort has to be directed towards coordinating local development policies and controls among all jurisdictions in this region.

The proposed Land-Use Fiscal Impact Model presented in the following section offers an analytical framework by which coordination of development patterns among jurisdictions can be achieved. Although detailed description of this model is presented in a working paper, the overall framework and potential applications of the model are emphasised in this report. In addition preliminary results from the use of the model are also presented.

THE LAND USE FISCAL IMPACT MODEL GENERAL DESCRIPTION AND PRELIMINARY TEST RESULTS

General Description of the Model

Fiscal crisis experienced by the local governments in recent years draw much attention to the development and the use of analytical techniques, by which the impacts of economic and consequently land development on local governments can be measured. Although few in number, several models and procedures were developed in recent years for determining the fiscal implications of development. The majority of these models however, deal with specific jurisdictions and do not address the intrajurisdictional issues in fiscal impact analysis.

What?!

The proposed Land Use-Fiscal Impact Model is aimed at dealing specifically with the problems of intrajurisdicational and through its formal structure, attempts to capture several essential features of the land use-fiscal impact interaction:

1. Determination of the spatial location of economic activity at the sub-metropolitan/regional level;
2. Demand for local government services and associated expenditures;
3. Local government revenues to be generated from the new development, and;
4. Revenue-Expenditure comparisons, with determination of the fiscal impact of land development on local governments.

Corresponding to these four characteristics, the Land Use-Fiscal Impact Model consists of four major components:

1. The Land Use component: primarily an extension of the Lowry framework; determines spatial distribution of economic activity;

2. The Expenditures component: projection of local government expenditure associated with the land development;

3. The Revenues component: projection of revenues to be generated for the local government from new development;

4. The Fiscal Impact component: determination of the fiscal impacts of land development on the local governments.

In short, the Land Use-Fiscal Impact simulation model is:

1. A static model; it simulates equilibrium of the spatial system and associated fiscal impacts at a given time.

2. It is an explorative model. By systematically varying the inputs it can reproduce alternative sets of spatial structures

3. It is a mathematical model. The entire system is represented by mathematical symbols.

4. And finally, it is a deterministic model. For a particular set of inputs, it produces an unique solution for the most likely state of the system.

The logical structure of the model is expressed in a series of simultaneous equations. A flow chart is provided in Figure 1 as a descriptive aid.

For treatment by the model, three activity types are identified:

1. Basic Sector: economic activities primarily serving non-local clients. Factors that effect these "export industries" are found outside the local economy. Therefore, as in Lowry model, they have been treated as exogenous to the model.

2. Service (Retail) Sector: economic activities predominantly serving local clients which consequently are affected by local conditions such as accessibility, land availability and regulatory constraints. This sector is therefore treated as endogenous to the model.

3. Household Sector: consisting of the residential population. It is assumed that the retail employment depends upon the population use and in turn the number of resident households depends upon the number of basic and service jobs available.

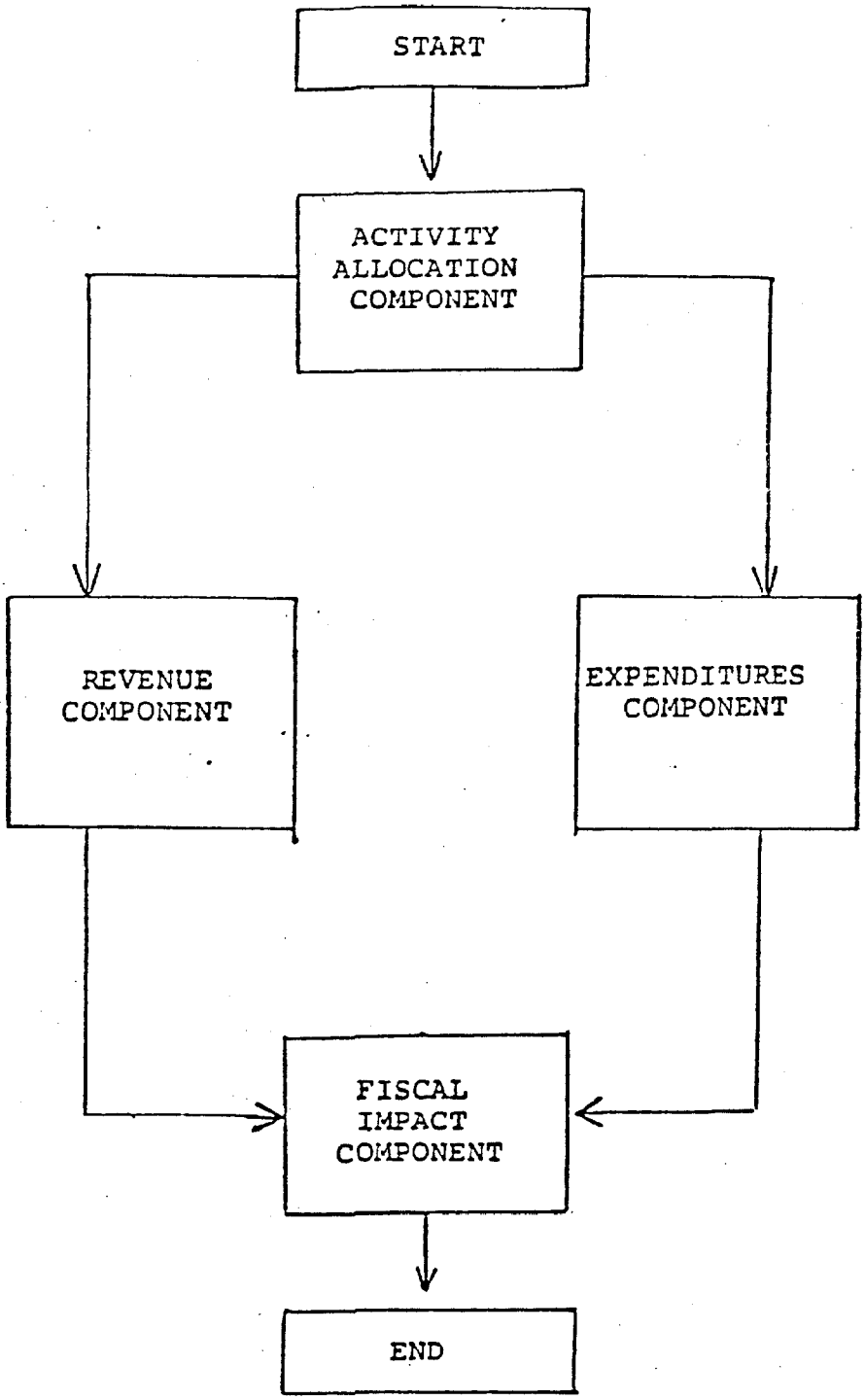

Figure 1. Land Use-Fiscal Impact Model Flow Chart

The fiscal impact of these economic and land use activities are estimated through the use of the following component models.

Expenditures Component

The impacts on government expenditures due to the estimated increases from basic sector, service sector, and residential activities described above are estimated by government jurisdiction. Although the equations (sub-models) are similar in structure, separate parameter values are used for municipalities and counties. Furthermore, expenditures will be estimated by service sector (i.e., police, fire, general government, etc.) using sector specific equations. In addition, operating and capital expenditures for each sector will be disaggregated and estimated separately in order to account for possible excess capacities available in present public facilities. It is hoped that by disaggregating as described above, the equations will yield more realistic estimates in measuring fiscal impacts. First, expenditures for specific services resulting from serving a particular activity, (e.g., residential, industrial, etc.) will be estimated. Total expenditures to serve activity "a" will be estimated by aggretating activity and service sector specific expenditures. Finally by totaling all activity specific expenditures, the aggregate expenditures for specific government jurisdictions can be estimated. The parameters of specific expenditure functions will be estimated through least squares regression method. In addition to residential population, basic sector employment and service employment, income and other explanatory variables will be included as independent variables.

Revenues Component

A similar structure in the expenditures component is used in revenues component of the model. Output values from the activity allocation component

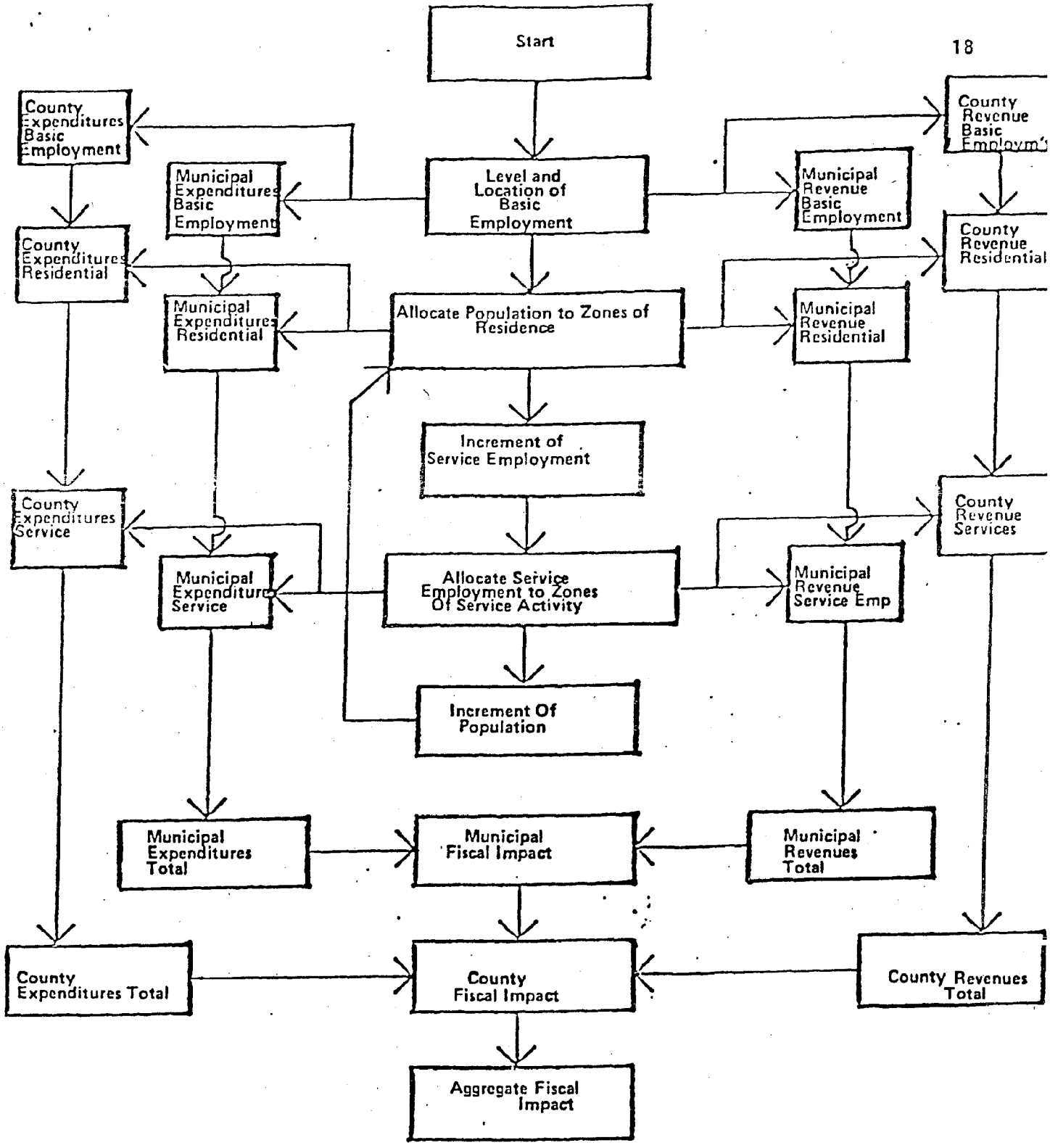

FIGURE 2. GENERALIZED FLOW CHART OF LAND USE – FISCAL IMPACT MODEL.

will be used as inputs in revenue equations. Initially estimates of revenue by type, for various activities, are made, aggregates of which yield activity specific total revenues. The summation of activity specific total revenues yield estimates of aggregate revenues.

Current formulas for distributing intergovernmental transfers will be used to estimate State and Federal transfers to local governments. Other revenues will be estimated through equations, parameters of which will be estimated through least squares regression.

Fiscal Impact Components

The fiscal impact component of the model is designed to calculate the net revenues generated from the economic activities estimated in the activity allocation component by subtracting the revenues from expenditures estimated with the revenues and expenditure components, described previously.

First jurisdiction and activity specific fiscal impacts are calculated. Total fiscal impacts for each jurisdiction estimated by aggregating activity specific impacts. This allows the identification of activity specific impacts as well as total fiscal impacts by jurisdiction. This information is particularly useful since it enables local decision-making authorities to either promote , discourage, or in more general terms to control growth within their government jurisdictions.

In addition to estimating jurisdiction specific fiscal impacts, aggregate (AFI) fiscal impacts (region wide impacts) can be estimated by aggregating impacts to all jurisdictions. This capability is useful in determining types of economic activities which might be encouraged within a region, in order to measure the adverse effects of growth and development.

Activity Allocation Component

Calibration of the model begins with determining the size and location of the basic sector employment. The population required to supply the labor force necessary to serve the basic employment needs is then determined by population multipliers reflecting local labor force participation rates. This projected population is then allocated to census tracts by a "Hansen type" accessibility function. (This helps to make the allocations a more realistic one, certain capacity constraints, reflecting restrictions resulting from specific economic, legal, and environmental conditions will be employed). Once the population associated with the basic employment is allocated to specific census tracts, the administrative units within which the activity takes place can be identified. This will be accomplished by aggregating the population allocated to census tracts, which comprise a specific administrative unit (i.e., municipality, county.) Service employment to serve the increased population associated with the basic sector activity is also predicted and allocated to service zones by a gravity function. Furthermore, population with this additional service employment will be predicted and allocated to residential zones. This process continues, until the incremental increase in service employment and population becomes insignificantly small, at which point the iteration will stop.

The procedure described above will generate estimates of retail employment, residential population and land use based on an exogenously determined basic sector, location and employment. Therefore, it generates values reflecting all stages of land development, including the secondary impacts of economic activities.

PRELIMINARY TEST RESULTS FROM THE APPLICATION OF THE MODEL IN GREENVILLE, SOUTH CAROLINA

Due to the availability of the data, the model's performance as a forecasting and policy analysis tool has been tested in Greenville, South Carolina, while the data collection tasks were ongoing for the coastal counties.

First, based on location specific information obtained from the Greenville County Planning Commission, the activity allocation component was calibrated. Given the distribution of basic employment, the performance of the model was tested by determining the distribution of population and service employment for 1977 using the model. Based on the results produced by the activity allocation component, estimates of revenue, expenditures and net revenues are produced using the revenue, expenditure and fiscal impact components, for the city of Greenville as well as for the county. The revenue expenditures components consist primarily of regression equations, estimated from cross-sectional information regarding county and municipal revenue and expenditures in South Carolina.

Testing the Land Use Component

The land use component of the Land Use-Fiscal Impact Model was tested independently from all other components, in order to assess its predictive performance. Given the 1977 distribution of basic employment and related land uses the model was run to allocate resident population and service employment and related land uses by methods and procedures explained above and in other reports. The results are evaluated separately, at census tract, city and sub-county levels. Evaluations of the distribution of resident population, residential land uses and service use were made and will be presented separately.

Overall the performance of the model at city and county levels was found to be very satisfactory.

The population allocated by the model to the city is 3.8% more than the actual 1977 figure, while the model underestimated the total population for county by 2.7%. Non-basic employment was underestimated substantially by 26% in the city. However, countywide non-basic employment was underestimated by only 2%. The underestimation of city non-basic (service) employment may result from the lag time associated with the development of service activity centers in the outskirts of the city. For example, since 1977, two new shopping centers opened in the urban fringe and suburban areas, and substantially changed the distribution of the service employment. In addition, several large department stores and professional service activities are moving to the fringe areas into shopping malls as well as new office parks. This results in a significant decline in non-basic employment within the municipal boundaries. It is possible that the projection of the model may be an early indication of this shift in non-basic activities.

Residential land use was overestimated for the city by 8% and for the county by 13%, while non-basic land use was underestimated by 23% in the city, 24% in the county. This divergence from actual residential and service land use, very likely results from the level of aggregation used in the model. It may be reduced substantially by diaggregating both residential and service land use into subcategories and by better predicting the densities associated with these activities. The sub-county population employment and land use estimates are presented in Tables 5 through 8.

Table 5 Sub-county Population Estimates, 1977

	Greenville County Planning Commission	Model Allocation	% Error
City	58,078	60,304	+ 3.8
Urban Fringe	68,368	65,210	4.6
Suburban Ring	64,006	59,442	7.1
Rest of the County	86,139	84,036	2.4
Total	276,591	268,992	- 2.7

Table 6 Sub-county Non-basic Employment Estimates, 1977

	Greenville County Planning Commission	Model Allocation	% Error
City	63,300	46,466	- 26
Urban Fringe	7,300	14,295	+ 95
Suburban Ring	5,000	13,372	+167
Rest of the County	7,100	6,594	- 7
Total	82,700	80,697	- 2

Table 7 Sub-county Residential Use Estimated, 1977

	Greenville County Planning Commission	Model Allocation	% Error
City	8,047	8,746	+ 8
Urban Fringe	12,792	12,788	0
Suburban Ring	31,003	37,439	+20
Rest of the County	N/A	N/A	N/A
Total*	51,842	58,973	+13

*Does not include the rest of the county

Table 8 Sub-county Service Use Estimates, 1977

	Greenville County Planning Commission	Model Allocation	% Error
City	2,172	1,662	- 23
Urban Fringe	2,261	1,786	- 21
Suburban Ring	2,363	1,670	- 29
Rest of the County	N/A	N/A	N/A
Total*	6,796	5,118	- 24

*Total does not include the rest of the county

Separate evaluations of the model's performance in allocating population, service land use and residential land use by census tracts were made using simple regression equations for the city and the entire county areas. In general, the model performed substantially better in the city than in the county. For all allocations in the city similarities between actual and estimated values, as measured by coefficient of determination, were found to be very high. The R^2 values ranged from .92 to .98.

The results for the entire county area, however, showed larger variations between the observed values and model allocations. The R^2 values for residential use, commercial use and population are .62, .75 and .50 respectively. These differences in the R^2 values may have resulted because all other municipalities in the county were considered equal to any other incorporated area. In addition, the lack of information on accessibilities to service employment may have distorted the population allocation associated with service employment. Nevertheless, the model's performance at the county level can be improved as information becomes more available and by further disaggreating the service sector employment. The regression statistics for observed values and model allocations are presented in Tables 9 and 10. In addition, graphic illustrations of model allocations and actual values are included in Figures 3, 4, and 5.

Table 9 Comparisons of Actual Values and Model Allocations by Census Tracts: City of Greenville, 1977

		R^2	CV
RES^{obs} = 79.9 + .77 $(RES)^{mod}$		.96	20
(103)	(2.31)** (18.39)*	(338)*	
COM^{obs} = -42 + 1.71 $(COM)^{mod}$		.92	39
(54)	(-2.20)** (13.17)*	(173)*	
POP^{obs} = 64.43 + .94 $(POP)^{mod}$		.98	8.3
(301)	(.44) (28.15)*	(792)*	

* Significant at 99% level
** Significant at 95% level

Table 10 Comparisons of Actual Values and Model Allocations by Census Tracts: Greenville County, 1977

		R^2	CV
RES^{obs} = 660 + .465 $(RES)^{mod}$		.62	58
(818)	(3.97)* (7.60)*	(7.79)*	
COM^{obs} = -23.67 + 1.49 $(COM)^{mod}$		.75	56
(103)	(-.90) (10.42)*	(108)*	
POP^{obs} = 1373 + .71 $(POP)^{mod}$		.50	46
(2406)	(1.84)*** (5.96)*	(35.55)*	

* Significant at 99% level
*** Significant at 90% level

Where:

RES^{obs}= observed residential acres in use by census tract

RES^{mod}= model allocation for residential acres by census tract

COM^{obs}= observed commercial acres in use by census tract

COM^{mod}= model allocation for commercial acres by census tract

POP^{obs}= observed population size by census tract

POP^{mod}= model allocation of population size by census tract

the preceeding evaluation of the performance of the land use component by sub-county areas as well as by census tracts suggests that the land use allocations, particularly at the municipal level, adequately represent the actual distribution of population and service employment and their land use. Nevertheless, there is room for improvement in the model's performance in urban fringe areas. It should be noted, however, that estimates of the aggregate municipal and county population and service employment are very accurate. Although the actual values will be used as inputs in revenue and expenditure components to determine the fiscal impacts associated with these population and employment levels, the use of the model not only as a land use forecast tool but also as an alternative to traditional methods of forecasting population and employment is not inappropriate. The revenue expenditure and fiscal impact estimates and the actual values are presented later in this chapter.

Testing The Revenue and Expenditure Components

Using the land use component, in which the location and size of basic sector employment was exogenously determined, the distribution of population and service employment was estimated by census tract for 1977. By aggregating the census tracts which comprise Greenville County and the city of Greenville, the population, employment and associated land uses were estimated for these

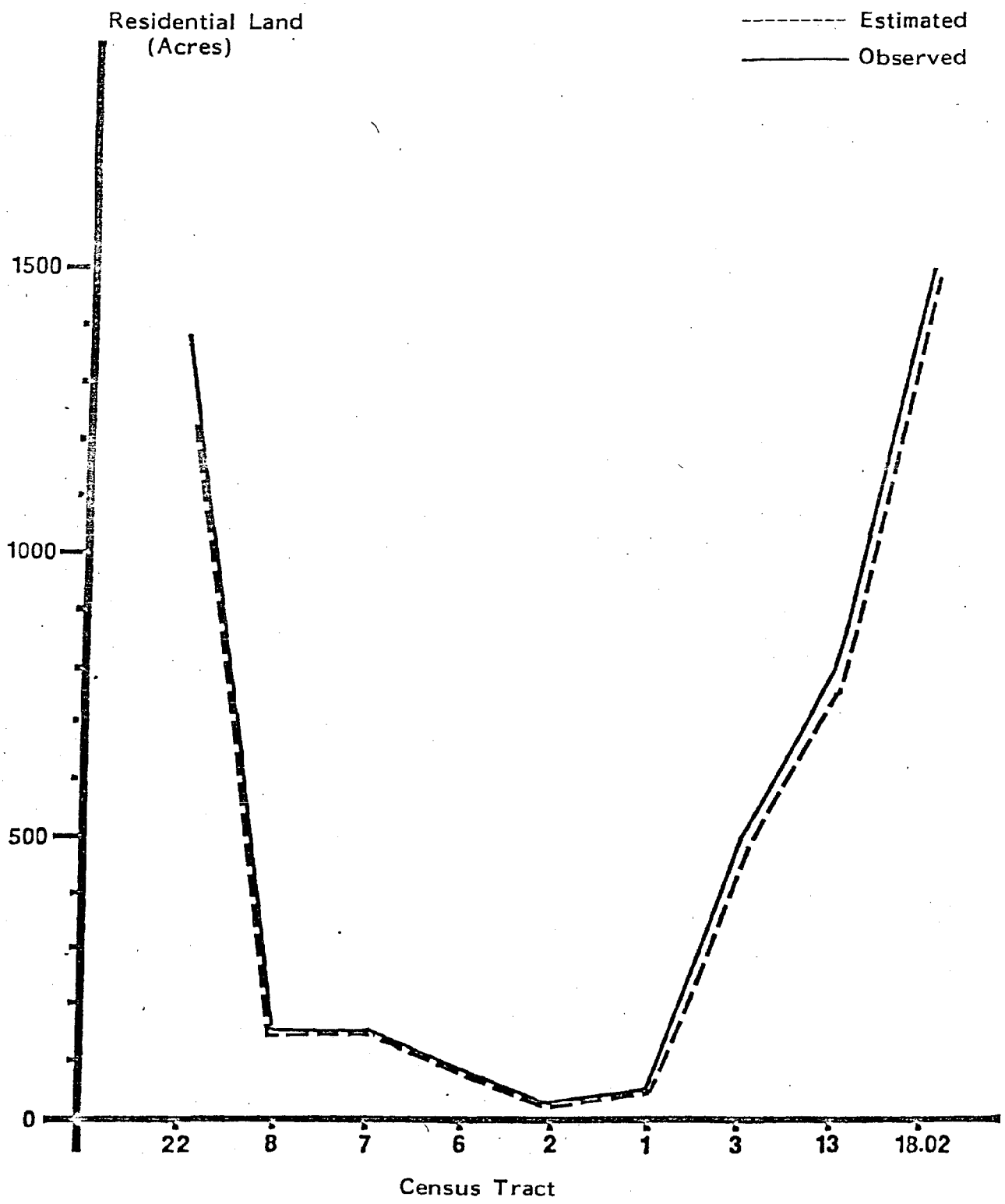

Figure 3. Greenville: Residential Use in Acres E-W Sections Through Central Census Tract Number 2

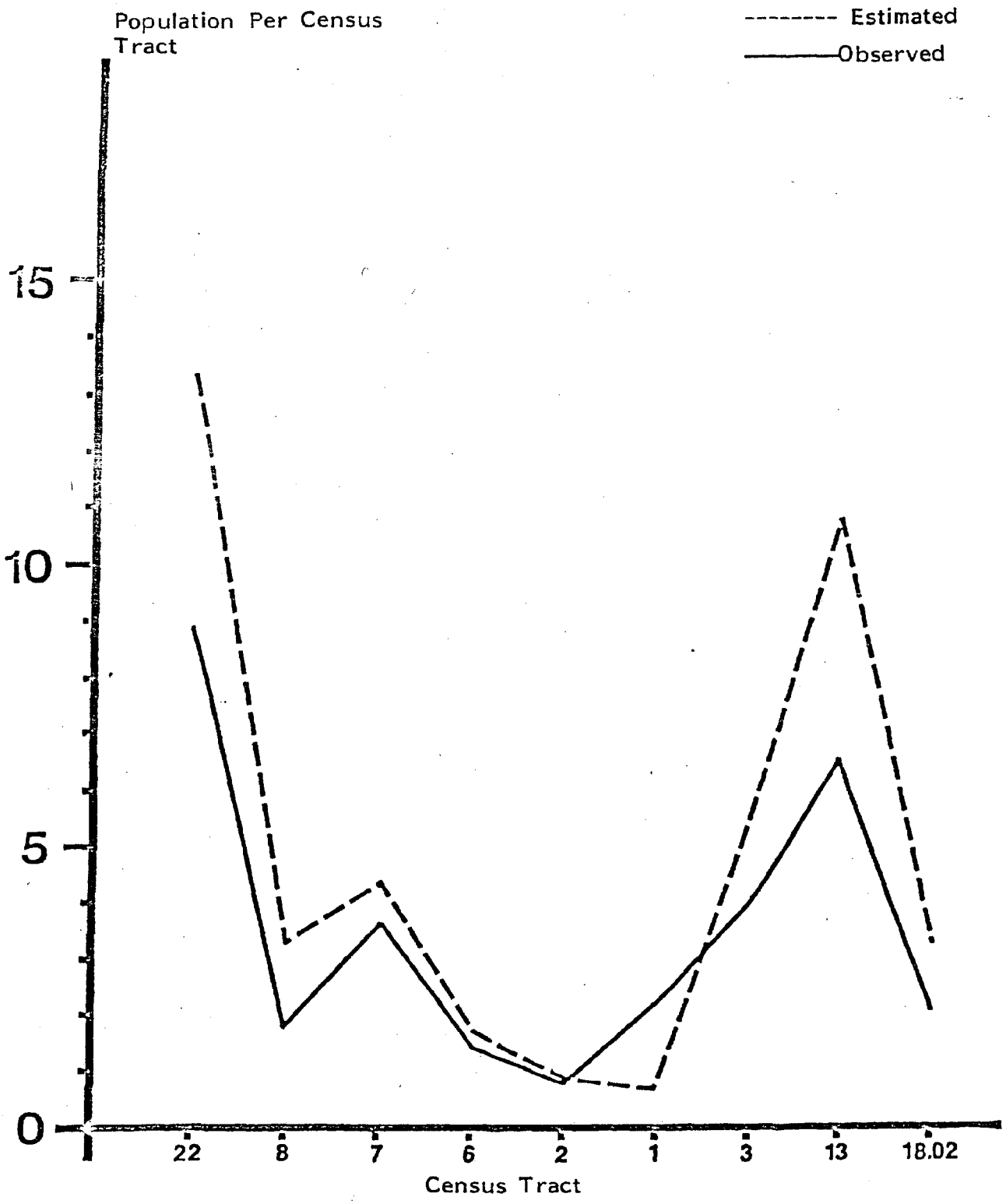

Figure 4. Greenville: Population E-W Section Through Central Census Tract Number 2

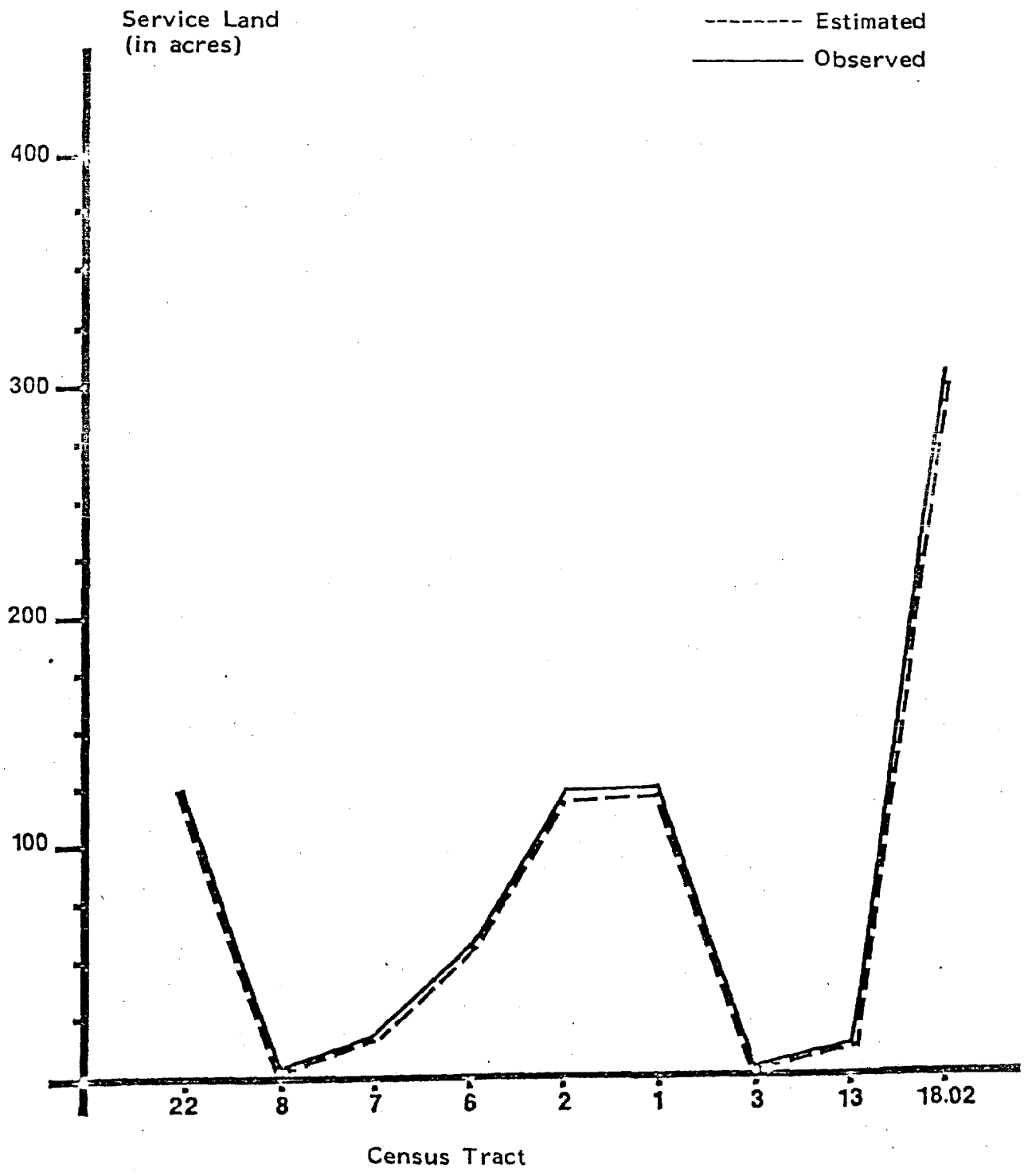

Figure 5. Greenville: Service Use in Acres E-W Sections Through Central Census Tract Number 2

jurisdictions. These values are used to estimate revenues and expenditures for the county and city of Greenville, based on equations presented in another working paper.

Municipal Revenue and Expenditures

The model estimates of municipal revenues and expenditures, with the exception of total expenditure and revenue, and public work expenditure categories, showed considerable deviation from the actual values. General government administration expenditure estimates deviated by 37% and intergovernmental revenue estimates by 88% from actual values. The police, civil defense and public works expenditures were underestimated by 23%, 8.7% and 4.8% respectively, while the model overestimated other expenditures by 34% for 1977. On the other hand, with the exception of intergovernmental revenue, which is over estimated by 83%, the model consistantly underestimated all revenue categories. Both the general property tax and zoning fees(MR1), and other fees (MR22) were underestimated, by 9.9% and 21% respectively. These results are presented in Tables 11 and 12 respectively.

County Revenues and Expenditures

The deviations in estimated county expenditures from actual values ranged from -117% in parks and recreation expenditures to +33% in health expenditures. The capital, health, police and operating expenditures were overestimated while all other expenditure categories were underestimated by the model. Although many county expenditure categories were not well represented by the model, the estimate of total expenditures was only 1.5% less than the actual value. The model performed in a similar manner in estimating the capital, highway and police expenditures. The estimates in these categories differed from actual values by -2.3, -9 and 7.8% respectively.

Table 11 Observed and Estimated Expenditures for City of Greenville, 1977

	Observed	Estimated (1975 $)	Estimated (1977$)	% Error	Regression Statistics R^2	CV
ME1	1690595	937111	1062684	-37	.89	4.6
ME2	2472176	1674004	1898320	-23	.94	2.7
ME3	1797526	1446182	1639970	-8.7	.98	1.2
ME6	2211001	1855157	2103748	-4.8	.83	5.3
ME16	1923694	2577927	2923369	+34	.86	5.7
ME17	10094995	9183430	10414010	+3.1	.94	2.9

Table 12 Observed and Estimated Revenues for the City of Greenville, 1977

	Observed	Estimated	% Error	Regression Statistics R^2	CV
(MR1) General Property and Zoning Taxes	6006092	5410318	-9.9	.96	1.73
(MR20) Inter-governmental revenues	1231100	2253726	+83	.51	23
(MR22) Fees	3194791	2504790	-21	.83	5.4
(MR19) Total Revenues	10820851	10583083	-2.2	.94	2.8
Fiscal Impacts (Net Revenue)	725800	169100	76	NA	NA

Table 13 Greenville County Observed and Estimated Expenditures, 1977

		Observed (in thousands of $)	Model 1 Estimate	% Error	Regression Statistics R^2	CV
E1	Total	29238	28798	-1.5	.78	52
E2	Capital	3088	3015	-2.3	.51	88
E3	Highways	3020	2738	- 9	.79	39
E4	Public Welfare	1070	740	-30	.88	55
E6	Health	1462	1956	+33	.68	65
E7	Police	3337	3621	+7.8	.91	34
E8	Parks & Recrea.	1715	-294	-117	.71	89
E10	Corrections	870	622	-28	.60	68
E11	Financial Adminstra.	1937	1322	-31	.85	36
E16	Operating	26150	33284	+27	.76	56

With the exception of charges (CR4), all county revenue categories estimated by the model were within 11% of the actual revenues. Total revenues and tax revenues both were overestimated by the model by 8.5% while intergovernmental revenues were underestimated by about 11%.

In spite of some of the serious limitations discussed previously, the resulting estimates are remarkably representative of actual revenues and expenditures, especially for the city of Greenville. The model overestimated the total municipal expenditures by 3.1% and underestimated the total revenues

Table 14 Greenville County: Observed and Estimated Revenue and Fiscal Impacts

Variables	Observed (in thousands of $)	Estimate	% Error	Regression Statistics R^2	CV
CR1 Total Revenue	28097	30495	+8.5	.84	46
CR2 Intergovernmental	11889	10525	-11	.96	14
CR3 Tax Revenue	12368	11308	8.5	.89	36
CR4 Charges	3804	7360	93	.66	97
Fiscal Impacts (Net Revenue)	-1141	+1697	248	NA	NA

by 2.2%. On the other hand, the county revenues were overestimated by +8.5% and -1.5% respectively. County expenditures were underestimated by -1.5%. The performance of the model in estimating the total revenues and expenditures for the city and the county was considerably better than in estimating the individual expenditure and revenue categories. In addition, estimates for the municipality were consistantly better than the county estimates.

Fiscal Impact Component

Using the estimates generated from the revenue and expenditure components for Greenville city and Greenville county, the net revenues, are calculated. These results are summarized in Table 15. A close examination of Table 15 suggests that the model correctly predicted the budget surplus for the city of Greenville experienced in 1977, although the net revenue was underestimated by 76%.

On the other hand, for Greenville county, the fiscal impacts (net revenues) estimated by the model indicated a surplus of $1.6 million, in

Table 15 Total Expenditures, Revenues and Fiscal Impacts
Greenville, S.C., 1977

GREENVILLE, S.C. - 1977
(in thousands of dollars)

	Expenditures			Revenues			Fiscal Impacts	
	Observed	Estimated	% Error	Observed	Estimated	% Error	Observed	Estimated
City of Greenville	10,095.	10,414.	+3.1	10,821.	10,583.	-2.2	725.	169.
Greenville County	29,238	28,798	-1.5	28,097	30,495	+8.5	-1,141.	1,697.
Regional Total	39,333.	39,212.	.003	38,918	41,078.	+5.5	-415.	1,866.

contrast to the budget deficit actually experienced in 1977. This is due primarily to the underestimation of total expenditures and overestimation of total revenues, a condition which could be improved substantially by improving the predictive performance of individual sub-models.

In summary, in spite of shortcomings in the data, the revenue, expenditure and fiscal impact estimates produced by the model for both municipality and county jurisdictions were fairly representative of actual values. Nevertheless, there is room for improvement in all the components of the model.

FUTURE DEVELOPMENT OF THE MODEL FOR THE SOUTH CAROLINA COASTAL REGION

The basic purpose of the first year of the model building process has been to obtain basic information for model development and application to the South Carolina coastal area. As indicated in the previous section of this paper and the other working papers, a great deal of information has been collected regarding trends in the Coastal Region. In addition, the structure and working procedures for the model have been developed to a significant degree. This final section of this paper will discuss the utility of the Clemson Land Use-Fiscal Impact Model and the prospects for applying this model in the South Carolina Coastal Region.

As indicated in the working papers directly relating to the structure of the model (i.e., The Coastal Energy Impact Model: Conceptual Framework and Structural Equations And An Initial Users Manual: Land Use Fiscal Impact Model), the basic nature and parameters of the model have been established. A county level application of the model was completed using Greenville County (due to the availability of data). The results obtained from testing the model's performance in Greenville suggest that the Land Use-Fiscal Impact Model can be employed successfully to test alternative growth policies and measure their impacts as well as to determine the population, employment, land use, and fiscal impacts resulting from increases in basic sector employment. These results were summarized in the previous section of this paper.

Several important factors regarding making this model operational should be mentioned. These include: 1) availability of data; 2) familiarity of the

users with the purposes and utility of the model: and 3) use of this model in an on-going, policy analysis role. Although these factors are interrelated, they will be discussed separately.

A significant amount of data are necessary for any resasonable planning effort at a local, regional, or state level. While the data requirements of this model are generally not greater than the type of information normally required for planning, most of the eight coastal counties do not have adequate information bases to apply this model at present. The most significant difficulty is in the data category of land use information. In a number of counties, this information is available only in a few incorporated areas. While the collection and use of land use data are stressed by state and regional bodies, it is primarily a local task to develop this information. Local responsibility for land use data (outside of specific environmental categories such as marshlands) is also desirable since local units of government have the greatest responsibility for using this information. Given their specific knowledge of local conditions, is is also reasonable to assume that these agencies are in a much better position to collect reliable information.

The utility of any planning technique is directly related to the familiarity of the users with the purpose, nature, and results of that method. Since county and municipal governments are the primary decision-makers in the S.C. Coastal Region, it would be desirable for individuals in these units of government to be involved in the use of the Land Use-Fiscal Impact Model. Certainly this approach would be desirable to one in which the model is a creation and possession of a body that is not directly linked to local governments. The Councils of Governments may provide a reasonable compromise between the necessary sophistication to operate the Model and accessibility to local decision-makers. This is

particularly feasible since the Model can be adapted for use by minicomputers.

A basic consideration in the development and proposed utility of this Model is that local planning agencies should be engaged in a process of studying growth trends in their planning areas to determine what demands will be placed on them. Given these demands, means of providing public services may be identified and proposed in a timely manner. Local agencies can go beyond a simple process of accepting change, however. In addition to projecting likely demands, the Clemson Land Use-Fiscal Impact Model provides a mechanism for determining consequences of alternative basic employment locations. Given this awareness, local units of government can act in a manner that shapes as well as meets the demands placed on them. The actual development of this attitude will require considerable encouragement from state agencies such as the S.C. Coastal Commission, and regional organizations such as Councils of Governments.

The Land Use-Fiscal Impact model is an important step in providing a framework for measuring impacts in a regional setting. Because of its structure, the model is sensitive to intra-jurisdictional population and employment spillovers, which are not addressed in currently available models. In addition, its simulation capabilities make the testing of alternative policies with respect to land development, taxing and growth management possible. More specifically, the measurement of impacts from alternative locations and varying sizes of activities as well as changing land use regulations can be evaluated. The Land Use-Fiscal Impact model is thus an important and useful tool for growth management and can aid in improving the effectiveness of local governments by providing more complete information regarding the impacts of anticipated development.

WORKING PAPERS

The Working Papers listed below represent technical reports of staff research undertaken to complete the tasks required in this project. More information on research results cited in this final report may be found in these documents.

Ersenkal, Olgun. The Coastal Energy Impact Model: Conceptual Framework and Structural Equations. Working Paper 103080, Department of Planning Studies, Clemson University, December, 1980.

Fadel, Donald J., Olgun Ersenkal. Employment Population and Expenditure Trends in the Coastal Region of South Carolina: 1967-1977. Working Paper 123080. Department of Planning Studies, Clemson University, December, 1980.

Ersenkal, Olgun. Determinents of Local Government Revenues and Expenditures in South Carolina. Working Paper 113180, Department of Planning Studies, Clemson University, December, 1980.

Nocks, Barry C. , Nann Boggs, Nicholas Avrakotos, and Danny Taylor. A Land Use Inventory of the Coastal Region in South Carolina. Working Paper 133080. Department of Planning Studies, Clemson University, December, 1980.

Nocks, Barry C. , James Hill. Public Facilities Data for the South Carolina Coastal Area. Working Paper 133180. Department of Planning Studies, Clemson University, December, 1980.

Nocks, Barry, Nann Boggs. Trends In Enrollment Patterns, Expenditures and Revenues for Education Facilities in the Coastal Region of South Carolina. Working Paper 133280.

James London. The Economic Impact of Industry and Energy Locations in Coastal South Carolina. Working Paper 5481.

Corey, J. Anthony, Olgun Ersenkal. An Initial Users Manual: Land Use Fiscal Impact Model. Working Paper 133080. Department of Planning Studies, Clemson University.